



Energy Efficiency and Sustainable Design Program Highlights

- DCAM's Sustainable Design program and "Conservation Team" ensure that Commonwealth facilities attain practicable goals in sustainable design and construction as well as achieve optimal levels of energy and water efficiency for existing, renovated, and new buildings. Through these efforts, DCAM promotes an integrated approach to construction that uses material, energy, water, and capital resources efficiently, minimizes site impacts, addresses the health issues relating to construction and indoor environmental quality, ensures least life cycle costs, and supports the use of environmentally preferable products.
- Over the past 18 years, DCAM has implemented 273 energy and water conservation projects of different varieties, yielding annual savings of approximately \$20 million.
- DCAM's primary program for retrofitting existing buildings is the Performance Contracting program, which involves the installation of energy- and water-related system upgrades without requiring up-front capital. Energy Service Companies guarantee a net positive cash flow to the Commonwealth through reduced utility bills.
- Performance contracting projects allow DCAM to promote innovative and renewable technologies, such as the installation of a biomass heating plant at Mount Wachusett Community College, a fuel cell at Cape Cod Community College, and other innovations.
- DCAM has developed a set of Sustainable Design Guidelines, as part of its "Instructions for Designers" guidance document, that describe the norms that all designers under contract to DCAM are expected to adhere to in all aspects related to the design of facilities statewide.
- DCAM's sustainable design program promotes the utilization of energy modeling services to optimize building designs as a set of integrated systems and also retaining third party building commissioning agents to ensure that building equipment and integrated building systems provide optimal performance and functionality throughout a building's life.
- The soon-to-be-constructed New Technology Center for the Cape Cod Community College is DCAM's first project to be registered with the US Green Building Council's LEED Program. This project is currently being designed to the LEED Silver standard (possibly Gold) and includes innovative features such as photovoltaic panels, a greywater reuse system, recycled & locally produced materials & many other high-performance features.
- Most projects now being advertised for design by DCAM will require at least one design scheme that will achieve LEED certification at a minimum level.
- A recently approved "Special Opportunities Partnership Initiative" grant from the Mass Technology Collaborative's Renewable Energy Trust will provide DCAM with \$2.2 million to apply to its projects for the study, design, and construction of renewable energy systems and related green building elements.



Energy Efficiency and Sustainable Design Program

As the state agency responsible for building design, construction, and major renovations of the Commonwealth's buildings, DCAM projects have a large impact on state resource use. DCAM's "Conservation Team" ensures that state-owned facilities attain practicable goals in sustainable design and construction as well as achieve optimal levels of energy and water efficiency for existing, renovated, and new buildings. The Team assists DCAM's "client" agencies to achieve these goals by providing technical assistance, including consultant expertise, and facilitation of energy and water conservation activities for state building and renovation projects. The Team also coordinates agency participation in utilities' energy efficiency incentive programs and manages energy savings "performance contracts" - retrofit projects completed for the purpose of energy and utility savings at state facilities. This report provides a brief synopsis of DCAM's activities in promoting energy efficiency and sustainable design at state facilities.

Programs for New Construction and Major Renovation of State Buildings

Sustainable Design Program

DCAM has developed a comprehensive sustainable design program. Sustainable design is an integrated approach to construction that uses material, energy, and water resources efficiently, minimizes site impacts, addresses the health issues relating to construction and indoor environments, and supports the use of environmentally preferable products. DCAM's Sustainable Design program aims to achieve high performance standards and aesthetic qualities without compromising building functionality.

The Conservation Team monitors all of DCAM's new construction and major renovation projects to assess opportunities to enhance a project's overall sustainability. The Team offers research and facilitates life-cycle cost analyses, and provides project-specific information and design specifications on materials, designs and technologies that reduce the life cycle cost of facility projects. These strategies result in increasing energy and water efficiency, enhancing occupant comfort, health and safety and reducing a building's long-term impact on the environment. As part of its sustainable design program, the Team also works to capture utility-sponsored incentives and rebates where available and to secure funding for renewable energy systems, as applicable.

Sustainable Design Guidelines

The Conservation Team is responsible for the continual development, implementation and updating of DCAM's Sustainable Design policies and procedures. The Team has developed a set of Sustainable Design Guidelines that articulate a number of key requirements for all projects; these are found in Appendix N of DCAM's Instructions for Designers. The Sustainable Design Guidelines detailed in Appendix N describe the design norms that all designers under contract to DCAM are expected to adhere to in all aspects related to the design of facilities statewide. These Guidelines reflect a set of best practices in sustainable design that appropriately balance the Commonwealth's environmental, energy, human health and productivity goals relative to the economic costs of achieving sustainable design for state facilities. These Guidelines have been tempered by real-world project and facility experiences.

Among the Sustainable Design interventions articulated in Appendix N of DCAM's Instructions for Designers are directives that designers perform Life Cycle Cost Analyses (LCA) in the specification of all major building systems. This requirement assures that investments are made in building components and systems that offer significant energy savings and reduced life-cycle costs over their useful life as compared to their conventional equipment counterparts. The Guideline specifies that available utility rebates be applied for to reduce any incremental cost of the energy efficiency measures included in project specifications. The Guideline also specifies a number of sustainable design requirements and additional design considerations for each standard construction division ranging from site work and structural elements to finishes, specialties and equipment. Finally, the Guideline advises that the DCAM Conservation Team be consulted for any additional assistance.

Energy Modeling

A key element of sustainable design strategies is optimizing the performance of a building's energy and envelope systems. Rather than approach this on a component-by-component, piecemeal, basis, DCAM utilizes energy modeling services to optimize building designs as a set of integrated systems. DCAM's Conservation Team manages the process of assigning energy modelers to projects and integrating their work with that of the subject project's design team. DCAM has contracted with a number of companies that offer these specialized services. These consultants work with design teams and utility partners to attain maximum available rebates for high efficiency equipment.

Commissioning

Building commissioning is a systematic process that helps ensure that building equipment and integrated building systems provide optimal performance and functionality throughout its life. Commissioning can be accomplished by many parties, though independent third-party commissioning is the preferred model. DCAM has begun to utilize third-party commissioning agents to provide the level of quality assurance and performance guarantees that will assure project and occupant satisfaction beyond building start-up and initial occupancy.

Sustainable Design Successes

There are many sustainable design interventions that have successfully been included in DCAM-managed projects for Commonwealth facilities. Many have optimized energy use and simultaneously maximized utility rebates to help buy-down any incremental cost of high- or premium-efficiency products. Some have utilized energy modeling expertise, and some have incorporated detailed commissioning protocols. Most projects adhere to the strict VOC (volatile organic compound) standards included in Appendix N – this helps to ensure healthy indoor environmental quality. Most projects include the use of at least some environmentally preferable products (EPPs) such as high-recycled-content structural elements or flooring or ceiling products.

A few projects stand as exemplars of sustainable design practice. The New Technology Center for the Cape Cod Community College, located in Barnstable, will begin construction in 2004. It is DCAM's first project to be registered with the US Green Building Council's LEED (Leadership in Energy and Environmental Design) Program. This project is currently being designed to the "LEED Silver" level standard and could achieve a "Gold" rating by the time it is complete. The project includes an optimal energy efficient design achieved via energy

modeling, site renewable energy (passive and active solar technologies), daylighting and careful selection and use of Environmentally Preferable Products (EPPs) and locally-produced materials.

Another notable project, in the final stages of construction, is the new Library and Resource Center at the Quinsigamond Community College, in Worcester. This building shares many of the features outlined for the Cape Cod project, though it is not a LEED-registered building. Among the key accomplishments of these and other sustainably-designed projects is the high level of indoor environmental quality and enhanced occupant comfort and satisfaction achieved due to daylighting strategies and the absence of VOCs polluting otherwise fresh air.

Among the leading-edge statements of DCAM's interest in sustainable design is a study that was commissioned in the summer of 2002 for the development of a new 500,000 gross square foot state office building at the former Registry of Motor Vehicles site on Nashua St. in Boston. As conceived in the study, that project, if funded and built, would achieve a LEED rating, be optimally efficient, utilize passive and active solar design strategies as well as other potential renewable energy resources, and optimize occupant comfort, enhance productivity, and ensure superior indoor environmental quality. This project represents the sustainable design planning that DCAM is beginning to require of all designers. Most projects now being advertised for design will require at least one design scheme that will achieve LEED certification at a minimum level.

Renewable Energy

DCAM has sought to utilize renewable energy sources for a number of projects, including some of those discussed above. The Conservation Team is currently undertaking a statewide assessment of wind power generation opportunities at state facilities. A recently approved "Special Opportunities Partnership Initiative" grant from the Mass Technology Collaborative's Renewable Energy Trust will provide DCAM with \$2.2 million to apply to its projects for the study, design, and construction of renewable energy systems and related green building elements. It is anticipated that DCAM will utilize that funding for at least ten projects to help buy-down the incremental costs associated with the design and construction of renewable energy applications.

Conservation Programs for Existing Buildings

Energy Performance Contracts

DCAM's performance contracting program provides energy- and water-related system upgrades without requiring up-front capital. These projects enable the Commonwealth to engage contractors, known as Energy Service Companies (ESCOs), who guarantee a net positive cash flow to the facility through reduced utility bills. These projects typically involve the study, design, and installation of upgrades to existing facilities' building systems (primarily mechanical and electrical equipment). In addition to guaranteeing that the facility will achieve a minimum level of energy savings, ESCOs train operations and management staff on the new equipment.

Energy performance contract projects orchestrated by DCAM's Conservation Team currently generate approximately \$12 million savings annually as of 3/1/03. A number of related benefits are achieved by the Conservation Team's work. These include, but are not limited to, capital improvements that are made at no direct cost to the Commonwealth, improved overall environmental performance of state owned facilities, including indoor environmental criteria, as well as reduced emissions associated with energy use, and other enrichments to overall state sustainability.

Some notable performance contracting project examples include:

- Mount Wachusett Community College in which an advanced biomass heating plant was installed with funding assistance from the Massachusetts Technology Partnership Collaborative;
- Cape Cod Community College, where a fuel cell was installed with funding assistance from the US Department of Energy;
- A \$30 million UMASS Medical Center project which included replacing several boilers and enhancing the institution's cogenerating capabilities; and
- The *Energy User News* Project of the Year at UMASS Boston, where the campus heating system was converted from all-electric to natural gas.

Ongoing projects include those at the Mass Bay Community College, Tewksbury State Hospital and the Bureau of State Office Buildings, and DCAM's largest and most comprehensive project to date, at the UMASS Amherst Main Campus. With an ambitious program of activities including ongoing and new projects, DCAM's Conservation Team continuously develops new energy projects at state facilities, developing approximately 6-9 new performance contract projects per year.

Energy Audits

The Conservation Team manages energy audits to help facilities better understand their energy and water usage and to develop strategies for cost-effective improvements. Results include reports that provide important information for planning future energy-savings projects. In some cases, DCAM or the client agency uses the audit as the basis for developing a design to retrofit existing infrastructure to improve operating efficiency.

The below matrix notes the savings associated with DCAM's energy efficiency initiatives.

<i>Utility-funded Projects Project Type</i>	<i># of Projects</i>	<i>Total Cost</i>	<i>Annual Savings</i>	<i>Savings to Date</i>	<i>CO2 (tons)</i>	<i>SO2 (tons)</i>	<i>NOX (tons)</i>
<i>Utility-funded Projects</i>	129	\$19,266,096	\$4,536,437	\$51,564,925	558,133	2,839	1,161
<i>Bond-funded Energy & Water Conservation</i>	31	\$16,822,811	\$3,054,003	\$32,667,095	221,230	1,125	476
<i>Performance Contracts</i>	33	\$82,805,560	\$12,762,347	\$61,037,743	339,371	2,272	912
<i>All Project Totals</i>	193	\$118,894,467	\$20,352,787	\$145,269,763	1,118,734	6,236	2,549

Contact Info

For more information on DCAM's Conservation Team activities, please see information on Energy Efficiency and Sustainable Design on the DCAM website at: <http://www.state.ma.us/cam>. For further information, please contact DCAM's Program Manager for Energy Efficiency and Sustainable Design, John DiModica, at 617-727-4030, x. 454, or Hope Davis, DCAM Deputy Director with oversight of the Conservation Team.